

Flute.

### DESCRIPTION

The invention relates to a flute consisting of i) a hollow resonator tube, which is open at both ends and which is provided with finger holes and keys, and ii) a hollow blow tube provided with a mouthpiece, which is open at both ends, wherein said blow tube can be coupled to the resonator tube with its open end located furthest away from the mouthpiece by means of a closing unit that can be fitted in the blow tube, which closing unit is composed at least of a closing element provided with a central passage for placement round a support pin positioned on the longitudinal axis of the blow tube, which support pin is at least partially provided with screw thread that is to mate with a screw cap, which can be mounted round the open end of the blow tube located closest to the mouthpiece, said support pin being provided with a longitudinal bore, which longitudinal bore terminates in an open support pin end that mates with the screw cap.

The invention also relates to a blow tube, a closing unit, a support pin, a screw cap and a resonator element according to the invention.

Such a flute, in particular a metal Boehm-type flute, is known, for example from US patent No. 1,376,004. To pass the air that the player blows into the blow tube via the mouthpiece to the resonator tube - so as to generate sounds and tones by means of the keys - the open end of the blow tube located closest to the mouthpiece is closed by means of a closing unit as described above. Said closing unit prevents the air that is blown into the tube from escaping via said - otherwise open - end and forces the air in the direction of the resonator tube. Thus the desired musical sounds and tones can be generated in the resonator tube by suitably operating (read: opening and closing) the keys that close the finger holes.

The closing unit strongly interferes with the propagation of the generated sounds and tones through the blow tube in the direction of the ear that faces away from the resonator tube. Flute players experience the fact that they only perceive (hear) sound and thus the dynamic qualities of the musical instrument on one side (ear) as a considerable impediment as regards their perception of the music. In addition, such a known flute has a diminished sound characteristic.

The object of the present invention is to overcome the above drawbacks and to provide a flute that has an improved sound characteristic, and according to the invention the flute is to that end characterized in that the passage is closed by an end plate mounted on the shaft end that faces towards the mouthpiece, the outer circumference of which end plate is substantially equal to the inner dimension of the blow tube.

It has been experimentally established that such a closed longitudinal bore functions as a sound or resonance chamber, which transmits the sounds and tones generated in the resonator tube to the other side of the flute player. Consequently, the flute player will perceive the music he is playing more clearly when playing a flute according to the invention, which significantly enhances the player's overall perception of the music.

More specifically, the dynamic qualities of the flute according to the invention are improved. Especially in the high and low registers the volume of the instrument is increased and the instrument becomes more flexible to play, whilst furthermore the homogeneity of the sound in the high and low registers is significantly improved. Furthermore, the amount of noise is significantly reduced, whilst in addition it becomes easier to blow the flute.

The end plate transmits the sounds and tones that are generated in the resonator tube to the other side of the flute.

More specifically, an improved seal is obtained in the

resonator tube in that according to the invention a circular groove is present in the circumferential edge of the end plate, in which groove a sealing ring that abuts against the inner wall of the blow tube can be fitted.

5               In a special embodiment of the flute according to the invention, the screw cap is provided with an internally threaded through bore, which bore is to mate with the support pin. The sounds generated in the resonator tube can be carried outside the flute more clearly and more loudly as a result of the open communication of said bore with the  
0 outside environment.

              Since the bore in the screw cap can be closed by means of a screw in a special version of this embodiment, the flute player is capable of influencing the sound characteristic/spectrum of the flute himself. Closing the longitudinal bore in the support pin and the  
5 connecting bore in the screw cap results in a closed sound or resonance chamber having a different soundwave characteristic than in the situation in which the longitudinal bore in the support pin and the connecting bore in the screw cap are not closed.

              According to a special aspect of the flute according to the  
0 invention, the screw cap comprises a circumferential flange extending into the open end of the blow tube located furthest away from the mouthpiece, which circumferential flange has a tapered diameter. The tapered diameter ensures that the cap will fully abut against the respective open end of the blow tube at all times, which has a positive  
5 effect as regards the dynamic qualities of the flute.

              In yet another embodiment of a flute having an improved sound characteristic, a resonator element can be placed on the support pin, which resonator element is provided with a central passage for placement round the support pin, said resonator element having at least  
0 one closable cavity.

              It has been experimentally established that such a closed

cavity functions as a sound or resonance chamber, which transmits the sounds and tones that are generated in the resonator tube to the other side of the flute player. Consequently, the flute player will perceive the music he is playing more clearly when playing a flute according to the invention, which significantly enhances the player's overall perception of the music.

More specifically, the dynamic qualities of the flute according to the invention are improved. The instrument produces more volume and is easier to play, in particular in the high and low registers, whilst furthermore the homogeneity of the sound in the high and low registers is significantly improved. Furthermore, the amount of noise is significantly reduced, whilst in addition it becomes easier to blow the flute.

The dynamic qualities are in particular improved in that the resonator element has an external dimension which is smaller than the internal dimension of the cylindrical blow tube. Thus, the resonator element does not close the blow tube, so that further deadening or absorption of sound signals is prevented.

In a special embodiment, the resonator element is composed of at least one cap-shaped element, which cap-shaped element is provided with a circumferential edge, which can be supported against the end plate. In this way a resonator cavity is formed in which the end plate transmits the sounds and tones generated in the resonator tube to the resonator cavity on the other side of the flute.

In another embodiment, the resonator element is built up of two cap-shaped elements, which are supported against one another via their circumferential edges.

In a special embodiment, in order to further reduce or entirely prevent the deadening of the sounds and tones that are being generated, the surface of the support pin that is exposed to the closed cavity is larger than the surface of the support pin that is in contact

with the resonator element. More specifically, the surface of the support pin that is exposed to the closed cavity is significantly larger than the surface of the support pin that is in contact with the resonator element.

Even more specifically, the surface of the support pin that  
5 is in contact with the resonator element is a line surface.

In this way absorption and deadening of the generated sounds and tones by the resonator element is prevented as much is possible, which leads to improved dynamic qualities of the flute according to the invention.

0 According to a special embodiment of the invention, the resonator element has a weight ranging between 0.5 and 5 grams, more in particular a weight ranging between 1 and 1.5 grams.

More specifically, an improved seal and consequently an improved sound characteristic is obtained if a circular groove is present  
5 in the circumferential edge of the end plate, in which groove a sealing ring that abuts against the inner wall of the blow tube can be fitted.

The invention will be explained in more detail with reference to the drawing, in which:

Fig. 1a shows an embodiment of a flute according to the  
0 prior art;

Fig. 1b shows an embodiment of a blow tube according to the prior art;

Fig. 2 shows a first embodiment of a blow tube according to the invention;

5 Fig. 3 shows a second embodiment of a blow tube according to the invention;

Fig. 4 shows a third embodiment of a blow tube according to the invention;

Fig. 5 shows a fourth embodiment of a blow tube according  
0 to the invention;

Fig. 6 shows a fifth embodiment of a blow tube according to

the invention.

Fig. 1a shows a Boehm-type flute, which is known per se. The known flute 1 comprises a blow tube 10 having open ends 10a and 10b, respectively. The blow tube 10 has a mouthpiece 11 provided with a blow  
5 hole 12. The blow tube 10 can be connected to the open end 20a of a resonator tube 20 with its open end 10b located furthest away from the mouthpiece 11. The resonator tube 20 has another open end 20b, and furthermore comprises several finger holes (not shown), which the player can open or close by means of suitable keys 21 via levers 22.

Thus, sounds or tones can be generated by blowing air into the blow tube 10 via the mouthpiece 11, which air finds its way out through the open end 20b of the resonator tube 20 or through the open  
holes and keys 21.

To prevent the air that has been blown in via the mouthpiece 11 from leaving the flute 1 via the open end 10a of the blow  
5 tube 10, said open end 10a, which is located closest to the mouthpiece 11, can be closed by means of a closing element (not shown in Fig. 1a) and a cap 13.

The cross-sectional view of Fig. 1 of a blow tube that is known per se shows the closing unit composed in part of a closing element  
0 14, which is configured as a fixed cylindrical member 14 in this embodiment. Usually the closing element 14 has an external dimension which is substantially the same as the internal dimension of the cylindrical blow tube 10.

It is known to use cork for forming the closing element 14 as it is currently used. The elongated cylindrical closing element 14 is provided with a longitudinal central bore 14a, which central bore 14a makes it possible to place the closing element 14 on a support pin 15. The support pin 15 is provided with an end plate 18 at its end 15a facing  
0 towards the mouthpiece 11, which end plate likewise has an external dimension which is substantially the same as the internal dimension of

the cylindrical blow tube 10.

More specifically, the support pin 15 is at least partially provided with screw thread 16 near its other free end 15b, which external screw thread 16 can mate with internal screw thread 17 of the cap 13 that is likewise shown in Fig. 1. After the closing element 14 has been introduced into the blow tube 10, it can be positioned or fixed in the blow tube 10 by means of the support pin 15 and a cap 13 and completely close the free open end 10a of the blow tube.

As described above, the configurations of blow tubes fitted with such a closing unit (composed of the closing element 14, the end plate 18, the support pin 15 and the cap 13) have this drawback that the flute player can only perceive the dynamic qualities of the instrument and/or the music he/she is playing to a limited extent. This leads to the flute player experiencing a less complete perception of the music while playing a flute.

Fig. 2 shows a first embodiment of the blow tube according to the invention. For a better understanding of the invention, like parts are indicated by the same numerals.

According to the invention, the support pin 15 is provided with a longitudinal bore 15c, which longitudinal bore 15c is closed by the end plate 18 near shaft end 15a and which is in open communication with the environment (albeit closed by the cap 13) near the other shaft end.

The longitudinal bore 15c functions as a sound or resonance chamber, i.e. the sound generated in the resonator tube is transmitted via the end plate 18 into the longitudinal bore 15c in the direction of the other side of the flute player. As a result, the flute player experiences a different, enhanced perception of the music, since the dynamic qualities of instrument have been improved.

The sound characteristic or tone spectrum of the flute according to the invention is improved as the volume in particular in the

high and low registers is increased, whilst also the homogeneity of the instrument in the high and low registers is improved. In addition, the amount of noise is significantly improved, and it becomes easier to blow the flute.

5           The improvement as regards the sound characteristic or tone spectrum of the flute according to the invention can be further enhanced in that in another embodiment as shown in Figs. 3a and 3b the screw cap 13 is provided with a through bore 13a, which is provided with internal screw thread 17. The support pin 15 can be mounted in said through bore .0 13a.

As a result of this aspect of the invention, the sound or resonance chamber formed by the longitudinal bore 15c is lengthened, so that an open communication is effected between the sound or resonance chamber and the environment. The sounds or tones generated in the resonator tube 10 can thus escape via the other side of the flute, so 5 that a flute having a significantly fuller sound or a sound spectrum and volume, in particular in the high and low registers, is realised with this embodiment.

Possibly - as also shown in Figs. 3a and 3b - the bore 13a 0 in the screw cap 13 can be closed by means of a screw 19. This enables the owner/player of the flute to influence the sound character of the longitudinal bore 15c himself as desired by keeping the bore 13a in the cap 13 open or closing it by means of the screw 19. This provides a novel type of flute having a more comprehensive and improved sound 5 characteristic as regards sound spectrum and volume, in particular in the high and low registers.

An additional advantage is the fact that the presence of the bore 13a in the cap 13 obviates the need to gear the length of the support pin 15 precisely to the dimension of the blow tube 10. With the 0 current flutes, the dimensions of the support pin must be precisely selected to enable accurate positioning of the closing unit with respect



to the mouthpiece 11 / the blowing opening 12 in order to realise a correct closing by means of the cap 13.

The distance between the mouthpiece 11 / the blowing opening 12 and the blow tube end 10a of the blow tube 10 varies according to the type of flute, and the length of the support pin 13 must be geared thereto.

As a result of the presence of the passage 13a, the length of the support pin 15 is no longer of particular importance, since this makes it possible to correctly position the closing unit with respect to the blowing opening 12 and to realise a correct, complete closing of the blowing tube end 10a by means of the cap 13.

The support pin 15 and the bore 13a of the screw cap 13 (and consequently the screw 19) have a corresponding diameter of at least 3.5 mm.

If the player wishes to close the longitudinal bore 15c and the bore 13a, it suffices to turn the screw 19 into the bore 13a until the screw 19 butts against the support pin end 15b.

To obtain a correct closing of the blow tube end 10a by means of the cap 13, the cap 13 is provided with a circumferential flange 13b - as shown in Fig. 3b - which flange can be received in the open blow tube end 10a that is located furthest away from the blowing opening 12 / the mouthpiece 11. The diameter of the circumferential flange 13b tapers off in the direction of the mouthpiece 11. As a result, a correct, circular and fully sealing abutment of the cap 13 in the blow tube end 10a is realised, so that the sound characteristic of the flute is not adversely affected.

Fig. 4 shows another embodiment of the flute according to the invention which likewise leads to a different, enhanced perception of the music by the musician, since the dynamic qualities of the instrument are improved with this embodiment, too.

In this embodiment a resonator element 30 is mounted on the

support pin 15, which resonator element is provided with a through bore 34 for placement on the support pin 15. The resonator element 30 is configured to have a cavity that functions as a resonator a cavity 33. More specifically, in the embodiment as shown in Fig. 4, the cavity of the resonator element 30 must be closed by placing the resonator element 30 into abutment with the end plate 18.

It has been found by experiment that the closed resonator cavity 33 formed as such leads to significantly improved dynamic qualities of the instrument. Especially the sound characteristic or tone spectrum of the flute according to the invention gains in volume, in particular in the high and low registers, whilst in addition the homogeneity of the instrument in the high and low registers is enhanced. The amount of noise in the sounds being generated is significantly reduced, and it becomes easier to blow the flute.

As is shown in Fig. 4, the cap-shaped resonator element 30 comprises a circumferential edge 31 that functions to mate with the end plate 18 for the purpose of realising a closed resonator cavity 33.

Furthermore, the resonator element 30 comprises a contact edge 32 that is supported on the circumferential surface 15d of the support pin 15. The deadening effect of the circumferential edge 32 on the circumferential surface 15d needs to be minimised in order to obtain a good transmission of the sound from the resonator cavity 33 to the support pin 15. In other words, to realise a good transmission of the sound from the resonator cavity 33 in the direction of the support pin 15, the surface 15d of the support pin 15 that is exposed to the closed resonator cavity 33 must be larger than the surface 15d of the support pin 15 that is in direct contact with the circumferential edge 32 of the resonator element 30.

More in particular, the surface 15d of the support pin 15 that is exposed to the closed resonator cavity 33 must be substantially larger than the surface 15d of the support pin 15 that is in contact with

the circumferential edge 32 of the resonator element 30.

More specifically, the surface of the support pin that is in contact with the resonator element 30 is a line surface as shown in the embodiment of Fig. 5.

5 Fig. 6 shows another embodiment of a flute according to the invention in which the resonator element 30 is built up of the two cap-shaped elements 30a-30b each provided with a central passage 34a-34b for placement the support pin 15. Each cap-shaped element 30a-30b has a circumferential edge 32a-32b that is supported on the circumferential  
0 surface 15d of the support pin 15. Likewise, each cap-shaped element 30a-30b has a circumferential edge 31a-31b, which edges abut against each other when placed round the support pin 15, thus forming a closed resonator cavity 33.

Analogously to that which is shown in Figs. 4 and 5, the  
15 surface 15d of the support pin 15 that is exposed to the resonator 33 must be larger than the surface 15d of the support pin 15 that is in direct contact with the material of the resonator element 30, i.e. the circumferential edges 32a-32b, so as to minimize the extent to which the sound in the resonator cavity is deadened by the resonator element  
20 30.

In order to drastically minimise the extent to which the sound is deadened by the resonator element 30, the embodiment shown in Fig. 6 may be constructed similarly to the cap-shaped element of Fig. 5, in which the circumferential edges 32a and 32b are configured as  
25 line surfaces.

Furthermore, as shown in the embodiment of Fig. 6, the support pin 15 may be provided with a longitudinal bore 15c, as is also shown in Figs. 3a and 3b, which longitudinal bore 15c is closed by the end plate 18 near the shaft end 15a and which is in open  
30 communication with the environment (albeit closed by the cap 13) near the other shaft end 15b.

Since the resonator element 30 forms an additional resonator cavity 33 that transmits the sound to the longitudinal bore 15c in the support pin 15, which functions as a resonator chamber, the dynamic qualities of the instrument are significantly improved, so that the flute player will experience a different, enhanced perception of the music he is playing.

As a result of the presence of the two resonator cavities 33 and 15c, the sound characteristic or tone spectrum of the flute according to the invention gains in volume in particular in the high and low registers, whilst in addition the homogeneity of the instrument in the high and low registers is improved. Furthermore, the amount of noise is significantly reduced, whilst it becomes easier to blow the flute.

The sound characteristic or tone spectrum of the flute according to the invention can be improved even further in that the screw cap 13 of the embodiment that is shown in Fig. 6 is provided with a through bore 13a, as is also shown in Figs. 3a and 3b.

As already stated above, the extent to which the sound is deadened by the resonator element 30 in the resonator tube must be minimal, and this is achieved in particular by designing the material portion (the circumferential edges 32, 32a-32b) that is supported on the support pin 15 to be significantly smaller than the surface of the support pin 15d that is exposed to the resonator cavity 33. Likewise, the extent to which the sound is deadened by the resonator element 30 can be further reduced in that the resonator element preferably has an external dimension which is smaller than the internal dimension of the blow tube. In this way the resonator element and the blow tube cannot come into contact with each other, thus preventing any deadening of sound.

Furthermore it has been established by experiment that in order to obtain an optimally improved sound spectrum of the

instrument according to the invention, the resonator element 30 has a weight ranging between 0.5 and 5 grams, more in particular between 1 and 1.5 grams.

5 Furthermore it can be ensured that the blow tube is adequately closed by the end plate 18 in that the end plate is provided with a sealing ring 20 around its outer circumference, which sealing ring may be fitted in a groove 18a formed in the outer circumference of the end plate 18. See Figs. 3b-4-5-6. This feature, too, leads to an improved sound characteristic of the flute according  
10 to the invention.

Furthermore it should be noted that the invention can be suitably implemented not only in flutes, but also in piccolos, alto flutes and bass flutes.